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(54) **OPTIMIZING 3D PRINTING USING SEGMENTATION OR AGGREGATION**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,261,542 B2 8/2007 Hickerson et al.
7,499,845 B1* 3/2009 Quincy et al. 703/7

7,766,641 B2 8/2010 Silverbrook
2007/0081828 A1* 4/2007 Radulski et al. 399/27
2008/0147221 A1* 6/2008 Suresh G06F 9/5038
700/100
2009/0015585 A1* 1/2009 Klusza 345/420
2010/0140849 A1* 6/2010 Comb et al. 264/401
2011/0087350 A1 4/2011 Fogel et al.
2011/0252163 A1 10/2011 Villar et al.
2012/0084968 A1 4/2012 Nath et al.

(Continued)

OTHER PUBLICATIONS

Sarik, et al., "Combining 3D Printing and Printable Electronics", In
International Conference on Tangible, Embedded and Embodied
Interaction, Feb. 19, 2012, 5 pages.

(Continued)

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(57) **ABSTRACT**

3D printing may be optimized by segmenting input jobs and/or combining parts of input jobs together. In an embodiment, a user-defined metric is received associated with each input job and this is used in scheduling input jobs to optimize latency and/or throughput of the 3D printing process, along with the printing envelope and other characteristics of the 3D printers used. In various embodiments, the scheduling may comprise dividing a 3D object into a number of parts and then scheduling these parts separately and/or combining 3D objects, or parts of 3D objects, from various input jobs to be printed at the same time on the same 3D printer. In various embodiments, the scheduling is repeated when a new input job is received and changes made during printing. In various embodiments, a user may submit an updated version of an input job which is already in the process of being printed.

20 Claims, 9 Drawing Sheets

